The CRUSHED STONE JOURNAL

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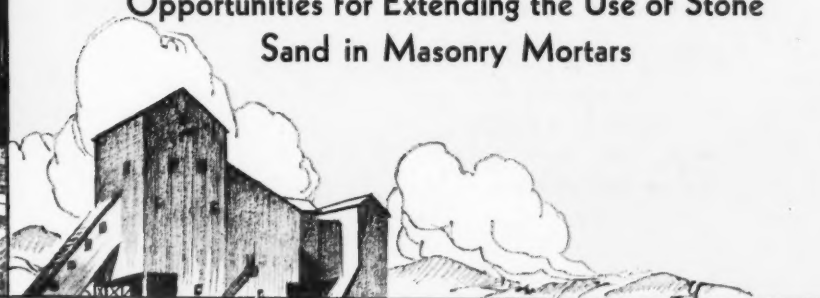
Uniform Cost Accounting Applied to the Crushed Stone Industry

Report of Interpretation Committee --- Trade Practice Rules

Opportunities for Extending the Use of Stone Sand in Masonry Mortars



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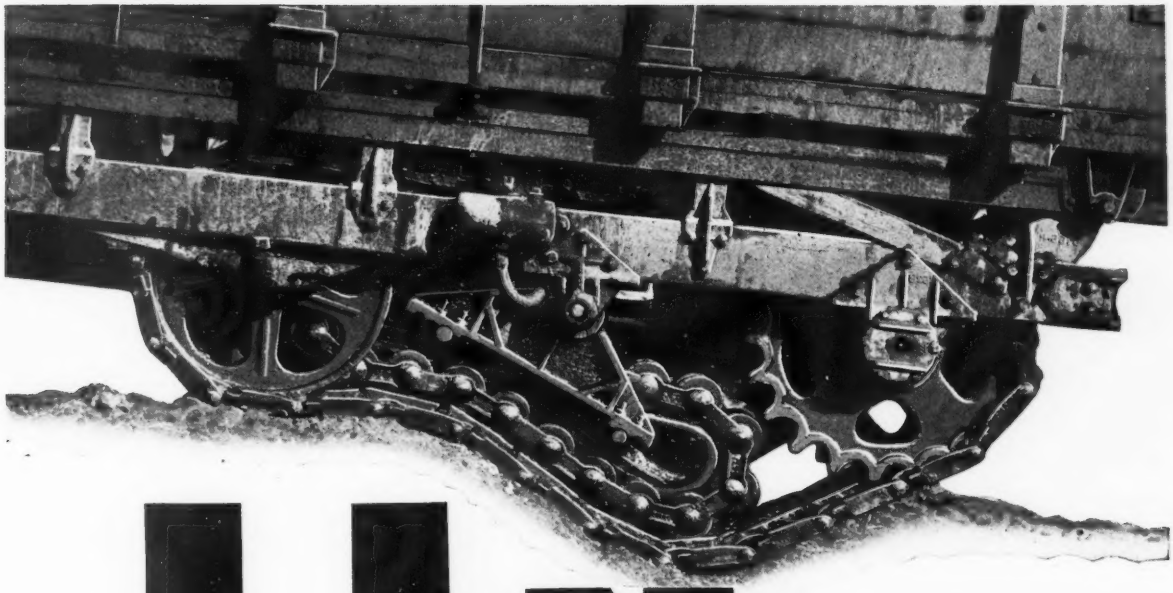

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The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

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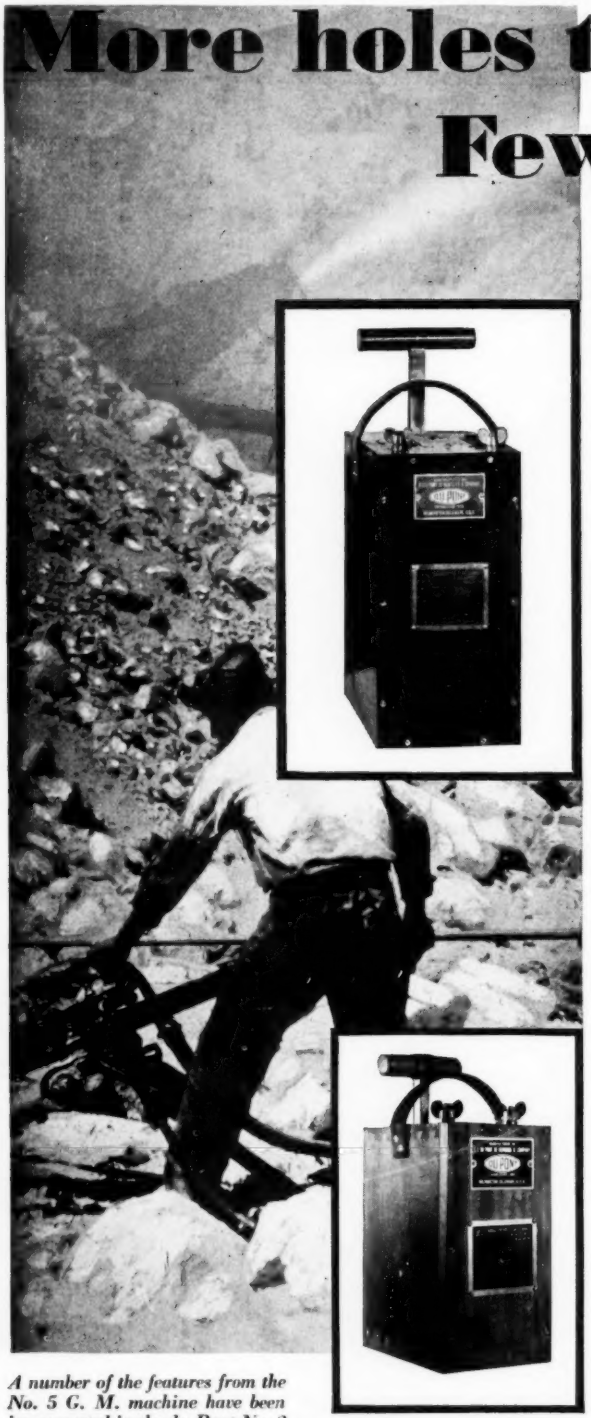

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THE
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Bureau of Public Roads' Tests Reveal Important Facts on the Strength and Workability of Concrete

◆ The U. S. Bureau of Public Roads recently concluded an investigation which was conducted primarily to determine the effect of variations in the quantity of coarse aggregate upon the strength, density and other properties of concrete pavement slabs. Many of the conclusions are of extreme importance to crushed stone producers and the following article should prove of particular interest and value.

IN the August issue of *Public Roads* issued by the Bureau of Public Roads of the U. S. Department of Agriculture[1] there appears an article entitled, "Studies of Paving Concrete" by F. H. Jackson, Senior Engineer of Tests and W. F. Kellermann, Associate Materials Engineer, of the U. S. Bureau of Public Roads. Unfortunately, this article is too lengthy for reproduction in *The Crushed Stone Journal* but the tests which it describes were carried out on such an extensive scale and the results are so significant that a study of the original paper in detail would be valuable.

The following description of the project is quoted from the article by Messrs. Jackson and Kellermann.

The tests which are reported in this paper were undertaken primarily for the purpose of determining the effect of variations in the quantity of coarse aggregate upon the strength, density, and other properties of concrete pavement slabs which had been placed and finished in accordance with normal field practice. Experience in the use of multiple sizes of coarse aggregate in concrete pavement work in North Carolina and other States during the past few years has indicated the possibility of increasing the quantity of coarse aggregate per unit of volume of concrete beyond the limit which had previously been considered good practice and in this way producing a denser as well as a more economical mixture, provided only that the uniformity of the grading of the coarse aggregate and, therefore, its void content was controlled rigidly by handling and measuring it in separate sizes.

It was realized at the outset that an investigation of this sort, involving as it did that most elusive property of concrete which we call "workability," could not be performed satisfactorily in the laboratory. In spite of strenuous efforts on the part of many investigators, no satisfactory laboratory test for workability has as yet been developed. Furthermore, this whole matter of workability is tied up so intimately with methods of handling and finishing used on the job that it is impossible to set up any laboratory standard which will give more than comparative results. In other words, a concrete which by some laboratory standard may be rated as "unworkable" may be quite workable under certain job conditions. For this investigation the percentage of visible honeycomb in the concrete, as revealed by a careful examination of the slabs, all of which were constructed in accordance with standard field practice, together with the uniformity of strength as determined by testing beams taken directly from the pavement, has been used to measure the uniformity and therefore the workability of the concrete. On this basis any concrete mixture which can be so handled as to produce a uniform homogeneous slab without unduly raising labor costs or reducing efficiency in operation is "workable" concrete, and any concrete which can not be so handled is not workable, in spite of any rating which it may receive by some arbitrary test.

Most of the information which we have regarding the properties of concrete at the present time has been obtained in the laboratory on small-sized beams and cylinders. While these data are of great value in helping us to understand some of the fundamental relationships governing the quality of concrete, as, for instance, the relation between water-cement ratio and strength, we must realize that it is the finished structure with which we are primarily concerned and that we are not in a position to make the best use of laboratory test data until we know to just what extent tests on molded specimens measure the quality of the concrete in the structure. This investigation furnished an excellent opportunity to study these relationships, both for crushing strength, through the use of molded cylinders compared with cores drilled from the pavement, and for transverse strength, through the use of molded beams compared with large beams taken from the pavement.

PROJECT DESCRIBED

In order to develop information along these lines, the Bureau of Public Roads during the summer of 1929 constructed an ex-

[1] This Journal may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., for the price of ten cents.

perimental concrete pavement 9 feet wide and approximately one-half mile long, using standard construction methods and appliances throughout, except that provision was made for creating planes of weakness to permit the removal of the pavement in sections for test purposes. The pavement was built at the Arlington Experiment Station of the Department of Agriculture at Arlington, Va., on the right of way of an abandoned electric line. This provided a graded, well drained, level subgrade which proved ideal for the purpose.

A total of 265 sections, each 9 feet in length, was constructed. The program called for the construction of six sections per day, three sections of each of two proportions, using a given type and gradation of coarse aggregate and method of finishing. In each group of three the water content was varied so as to produce a variable consistency ranging from the driest mix which it appeared possible to place without undue effort on the part of the finishers to a consistency approximating a 2 to 3 inch slump. No effort was made to produce wet consistencies such as have sometimes been used in the past, because it was felt that the dangers of overwet concrete are sufficiently well known and require no demonstration. On the other hand, the water-cement ratio method of proportioning, the adoption of which is being strongly urged, encourages the use of dry concrete, so that it seemed desirable to study mixtures of this sort rather than the wet consistencies which are recognized as undesirable by everyone.

MATERIALS AND PROPORTIONS

In order to cover adequately the question of type of coarse aggregate as it affected the workability of the concrete and therefore the limiting quantity which might be used with safety, a siliceous limestone having a rather sharp angular fracture and a bank gravel containing some crushed fragments were used in the tests. In addition, a limited number of sections were laid with blast furnace slag as coarse aggregate.

The cement was a standard brand Portland, meeting all requirements of the American Society for Testing Materials. It was shipped by car direct from the mill to the site of the work and all of the cement came from one bin. The results of physical tests of this cement are given in Table 1.

The fine aggregate consisted of sand from the Potomac River, having a fineness modulus of 2.65. Average test data are given in Table 1. It was realized, of course, that the grading and other characteristics of the sand used in these experiments would have a marked effect upon the amount of coarse aggregate which could be used. It is well known that in general the finer the sand, the higher the percentage of coarse aggregate by volume which may be employed without exceeding the limits of workability. However, it was obviously impossible to study any great range in fine aggregate gradations in a program such as this. It was decided, therefore, to use a single sand of average gradation with varying percentages of coarse aggregate, beginning at a value sufficiently low to insure a well-oversanded mix for the particular type of sand selected and increasing the amount of coarse aggregate by definite steps until a distinctly undersanded mix, as judged by laboratory standards, had been obtained.

The results of the physical tests of the three coarse aggregates are given in Table 2. The limestone was obtained from Martinsburg, W. Va.; the gravel from Fredericksburg, Va.; and the slag from Birdsboro, Pa. Each aggregate was ordered shipped to the job in three separate sizes, as follows: ¼-inch to ¾-inch, ¾-inch to 1¼-inch, 1¼-inch to 2½-inch. The separated sizes were combined by weight to give the combined aggregate gradations indicated in Table 3.

It will be noted that in the case of the gravel and the crushed stone two gradings were employed. Grading A is the so-called straight-line grading, showing an even distribution of sizes from the maximum down to ¼-inch. Grading B in the case of the gravel ranged in size from ¼-inch to 1¼-inch, with a surplus in the finer sizes. This grading was used because of the economic importance of this type of gravel in certain sections of the country. Grading B for the crushed stone showed a deficiency in the finer sizes and was used to simulate a condition often met with in practice whenever a demand exists for these finer sizes for bituminous work, resulting in a tendency to rob the concrete aggregate of these sizes. The sieve analysis curves for the combined gradings are shown in Figure 1.

TABLE 1.—*Physical properties of cement and fine aggregate*

1. Portland cement:
   - Fineness, percentage retained on 200-mesh sieve ---- 14.7
   - Time of set (Gillmore)—
     - Initial ---- 3 hours, 8 minutes.
     - Final ---- 6 hours, 3 minutes.
   - Steam test for soundness ---- Satisfactory.
   - Normal consistency, per cent ---- 22.6
   - Tensile strength (pounds per square inch, 1:3 Ottawa sand mortar)—
     - At 7 days ---- 315
     - At 28 days ---- 400

   (Results are average of 14 samples tested.)
2. Fine aggregate:
   - Sieve analysis [1]—
     - Total retained on ¼-inch screen, per cent ---- 1
     - Total retained on No. 10 sieve, per cent ---- 14
     - Total retained on No. 20 sieve, per cent ---- 32
     - Total retained on No. 30 sieve, per cent ---- 45
     - Total retained on No. 40 sieve, per cent ---- 69
     - Total retained on No. 50 sieve, per cent ---- 86
     - Total retained on No. 80 sieve, per cent ---- 94
     - Total retained on No. 100 sieve, per cent ---- 96
     - Total retained on No. 200 sieve, per cent ---- 97
     - Silt and clay, per cent ---- 2.8
   - Apparent specific gravity ---- 2.65
   - Weight per cubic foot (dry-rodded), pounds ---- 102
   - Absorption (Rea's method), per cent ---- 0.7
   - Voids, per cent ---- 33
   - Organic matter (color test) ---- Satisfactory.
   - Strength ratio—
     - 7 days ---- 96
     - 28 days ---- 113
   - Description: Sand consists essentially of angular quartz grains, containing some chert, feldspar, and mica.

[1] Sieve analysis is average of 96 samples tested.

TABLE 2.—*Physical properties of coarse aggregates*

Type of aggregate	Specific gravity	Absorption	Wear	Weight per cubic foot (dry rodded)	Voids
		Per cent	*Per cent*	*Pounds*	*Per cent*
Gravel, grading A	2.67	0.27	14.3 [1]	108	35
Gravel, grading B	2.64	.43		105	36
Stone, grading A	2.72	.12	14.4 [1]	102	40
Stone, grading B	2.72	.12		101	41
Slag	2.47	.....	12.2	87	44

[1] Not standard test; made with crushed rock.

TABLE 3.—*Gradings of coarse aggregate*

Aggregate	Grading	Per cent by weight passing round-opening screens			
		2½-inch	1¼-inch	¾-inch	¼-inch
Gravel	A	100	59	25	0
Do	B	.....	100	60	0
Stone	A	100	59	25	0
Do	B	100	37	10	0
Slag	A	100	59	25	0

Test Specimens

For each of the 265 sections, 4 beams and 4 cylinders were made as control specimens. The cylinders were 6 by 12 inches and the beams were 7 by 7 inches in cross-section and 30 inches long. The slabs were provided with planes of weakness so that they could readily be cracked into smaller test slabs 27 inches wide and 9 feet long. From each of these 9-foot slabs, 2 feet were broken off each end and discarded thus producing specimens 5 feet long. These were later tested in a specially constructed machine, load being applied at the third points.

As will be noticed from the above description this test was conducted on a very large scale and full opportunity was given to study the strength of concrete in the form of molded cylinders, molded beams, cylinders drilled from the pavement slabs and beams made by breaking up the pavement slabs. From this investigation conclusive results have been obtained and the following observations, conclusions and recommendations are quoted from the article.

STUDIES OF INDIVIDUAL TEST SECTIONS

In order to make it possible to study the manner in which the several variables which were being investigated affected the relative strength of individual sections, it was considered advisable to plot the results of tests, section by section. This has been done in Figures 33 to 37, inclusive, (figures not included, refer to *Public Roads*) in which the results of the various strength tests on each section have been indicated, together with the mix, slump, water-cement ratio, and average percentages of honeycomb. In each group of three sections the concrete having the lowest slump appears to the left and the concrete having the highest slump to the right. In each group of three sections lines have been drawn between the plotted values of compressive strength and modulus of rupture to indicate the trend of variation of strength with increasing slump. These curves should not be looked upon as indicating a quantitative relation, since the abscissa does not represent a variable. The various trends to which attention has been called may easily be traced throughout the entire series by reference to these figures. There are several points to which attention is especially called.

1. For each group of tests a very distinct relation exists between the consistency of the concrete as measured by the slump test and the water-cement ratio. Almost invariably it will be found that, in each group of three sections, a direct relation exists which indicates that the slump test is a very good measure of the relative amount of water in a given concrete, even within the rather narrow limits covered by this study.

2. In general, the additional water required to maintain workability in the mixtures containing high percentages of coarse aggregate does not result in an increase in slump. The upper, left-hand panel of Figure 33 is an exception to this rule.

3. The crushing strength of the concrete in the individual sections follows, in general, the water-cement ratio law. Exceptions may be observed in certain instances, many of which may be explained by the use of concrete which is too dry to be workable. It must be remembered, of course, that in these charts each point represents the average of only two tests in the case of the control specimens and the cores and four tests in the case of the slabs. Individual variations from the general rule are therefore not surprising.

4. There is a marked tendency for the flexural strength of both beams and slabs to fall off for the dry mixes. The tendency is more marked in the case of the slabs, probably because of the fact that under the standard method of molding employed for the control beams it was possible to fabricate more uniform specimens with the drier mixes than by the methods employed in placing the slabs. This tendency is illustrated by reference to sections 3, 17, 25, 32, 50, 71, 85, 122, 149, 180, 211, 230, and 247.

5. In 60 out of a total of 89 groups of three sections each, the section having the highest water-cement ratio showed a slab strength as high as or higher than the corresponding section in the same group having the lowest water-cement ratio. Attention is called to the fact that in each group of three sections the range in the water-cement ratio was only sufficient to produce a variation in consistency from dry to medium and that in no case was the water-cement ratio high enough to produce concrete of wet or sloppy consistency.

It should also be noted that whereas the drier mixes would for the most part be rated as workable by laboratory standards, such mixes were not in general found to be workable under the methods of placing and finishing pavement slabs now commonly used. The dry mixes may therefore be considered as lying outside of the range of plastic mixes to which the water-cement ratio law applies, and this fact accounts for the falling off in strength.

6. In these same 60 groups, the section in each group having the lowest water-cement ratio was honeycombed in all cases. On the other hand, in 40 out of the 60 groups, honeycomb was entirely absent from the section having the highest water-cement ratio, with 13 out of the remaining 20 showing less than 1 per cent honeycomb.

7. The slump for the driest mix in each group averaged from one-fourth inch to 1 inch, while the slump for the corresponding section in each group having the highest water-cement ratio averaged from 2 to 3 inches.

The above indications point emphatically to the danger of using mixes of less than 2-inch slump in concrete paving work with the methods of finishing in common use today. The use of medium consistencies such as were obtained in these tests with a 2 to 3 inch slump will not only give as high or higher slab strength than the drier mixes but will greatly decrease the tendency to honeycomb and thus will promote uniformity.

8. In general, the presence of honeycomb in the slabs, although very seriously affecting the flexural strengths of the slabs themselves, was not accompanied by lower crushing strengths of the cores drilled from the slabs. Neither was there any relation between the extent of honeycomb in the test slabs and the amount of honeycomb in the cores drilled therefrom. These observations lead to the conclusion that neither the crushing strength nor freedom from honeycomb of cores is necessarily an indication of the homogeneity of the concrete in the slab.

CONCLUSIONS STATED

For the materials, proportions, and methods of placing used in these tests the results of the investigation justify the following conclusions:

1. For a constant sand-cement ratio an increase in the quantity of coarse aggregate beyond the limits ordinarily employed in practice decreased the strength of the concrete in the pavement substantially in proportion to the amount of additional water required to maintain workability.

2. For corresponding increases in the water-cement ratio the percentage of reduction in flexural strength was somewhat less than the percentage of reduction in crushing strength.

3. The workability and uniformity in strength of the concrete was decreased in proportion to the amount of coarse aggregate added.

4. The workability of the concrete was greatly reduced by decreasing the maximum size and at the same time increasing the amount of fines in the gravel coarse aggregate, even though

the corresponding variations in the percentage of voids in the gravel and in the value of b/b_0 for the concrete were small.

5. For the gravel concrete the reduction in workability for any mix caused by the use of the poorly graded gravel was greater than the reduction in workability caused by increasing the percentage of coarse aggregate in the concrete containing the well graded material (See Fig. 22) (Refer to *Public Roads*).

6. For a given consistency as measured by the slump test, different gradations of gravel produced different degrees of workability. (See Fig. 23.) (Refer to *Public Roads*).

7. For a given gradation of coarse aggregate the consistency as determined by the slump test measured the workability of the concrete.

8. For a given proportion, higher slab strengths were obtained with concrete having a medium consistency (2 to 3 inches slump) than with very dry concrete (¼ to 1 inch slump).

9. In order to secure satisfactory uniformity and freedom from honeycomb it was necessary to use a consistency corresponding to a slump of approximately 2 to 3 inches.

10. The various types of finishing machine employed in these tests gave approximately the same results.

11. For concrete reasonably free from honeycomb, the strength of the control beams appeared to be a satisfactory measure of the strength of the corresponding pavement slab.

12. Neither the amount of honeycombing observed in the drilled cores or the crushing strengths developed by the drilled cores measured the extent of honeycomb in the pavement slabs or the flexural strength developed by the pavement slabs.

RECOMMENDATIONS

On the basis of the information produced by these tests, the following recommendations are made:

a. That all specifications for concrete for pavements contain a definite requirement covering consistency. The slump test is recommended for this purpose.

b. That the use of paving mixes showing less than 2-inch slump should be discouraged.

c. That specifications for consistency of paving concrete to be finished by any of the methods now in use be revised when necessary to provide that the concrete have a consistency corresponding to a slump of from 2 to 3 inches.

Discussion by A. T. Goldbeck

Director, Bureau of Engineering, National Crushed Stone Association

IN addition to the above conclusions certain important facts are revealed by the test results. For illustration, these tests demonstrate a truth which has been proven in our own laboratory, namely, that the characteristics of the coarse aggregate have a great effect on the strength and other qualities of the resulting concrete. In Figures 1, 2 and 3 (Figures 10, 11 and 12 in the original paper) are plotted the average strength results for all three aggregates of all gradations used. It will be noted that the particular stone used gave outstandingly superior results in transverse strength. Had other aggregates been used, still different results would probably have been obtained.

The question of effect of water-cement ratio on strength is one frequently raised. For equivalent water-ratios in the gravel and stone concretes, the stone concrete was considerably higher in transverse or beam strength than the gravel concrete. In fact, the stone concrete (Grading A) of highest average water-ratio (0.97) was much higher in strength than the gravel concrete (Grading A) having the lowest average water-ratio of the gravel concrete series, (0.86) the respective values for modulus of rupture being 695 for the stone and 565 for the gravel concrete. (Slab strengths at 9 months.) The stone concrete had 4.86 sacks of cement and the gravel, 5.53 sacks per cubic yard. *Certainly the coarse aggregate is an important factor in the strength of the pavement slab.*

It is to be noted also that although in general the stone concrete cylinders were lower in compression than the gravel cylinders, the reverse is true of the cores drilled from the pavement sections. Judging from these results some question may properly be raised as to whether the molded 6 by 12-inch cylinder tested in compression is a proper specimen for judging the quality of pavement concrete with 2½ inch maximum size stone aggregate. The molded beams, on the other hand, gave results which agreed very well with those obtained with specimens from the actual pavement slabs. *The beam test for concrete pavement control is well justified by these tests.*

The matter of gradation of coarse aggregate and its influence on the strength and workability are of importance. It is of interest to note that the "straight-line" gradation from ¼ to 2½ inches (25 per cent passing ¾ inch) gave higher results in stone concrete than the ¾ to 2½ inches (10 per cent passing ¾ inch). It is also interesting to know that the small size gravel (¼ to 1¼ inch) which is commonly supposed to give high workability, actually produced concrete which had the greatest amount of detrimental honeycomb at the bottom of the slab and this helped to reduce the slab strength. Even the gravel concrete made with small size gravel and having a high sand content (1:2:3½) showed a relatively large amount of honeycomb.

Quoting from Messrs. Jackson and Kellermann's article (page 164, Vol. 12, No. 6, *Public Roads*):

> Reference to Table 11 will show that the values for the ratio of b to b_0 and for the mortar-voids ratio (volume of mortar as determined by adding the absolute volumes of cement and sand and the volume of water, divided by the volume of voids in the dry-rodded coarse aggregate) were substantially the same for corresponding mixes using A and B grading. Moreover, the values for these ratios in the 1:2:4 mixes using gravel are just about the same as for the 1:2:3½ mixes using crushed stone. On the assumption that these ratios are significant in controlling workability, this would indicate that the workability of the two gravel concretes should be about the same and also that the 1:2:4 gravel concrete should have about the same workability as the 1:2:3½ stone concrete. Referring, however, to Figure 22 and assuming that the presence of honeycomb in the finished structure is a reasonably satisfactory measure of the workability of the concrete going into the structure, we find an average of about 1 per cent honeycomb in the 1:2:3½ stone concrete, about 1½ per cent in the 1:2:4 gravel concrete, grading A, and over 6 per cent in the 1:2:4 gravel concrete, grading B. Even the 1:2:3½ concrete, gravel grading B, showed

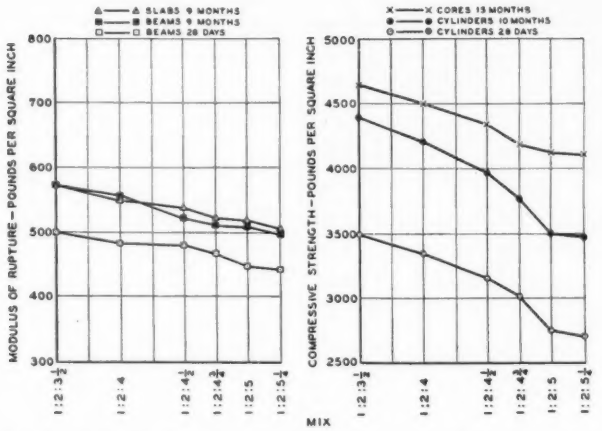

Fig. 1—Relation Between Strength of Gravel Concrete and Mix

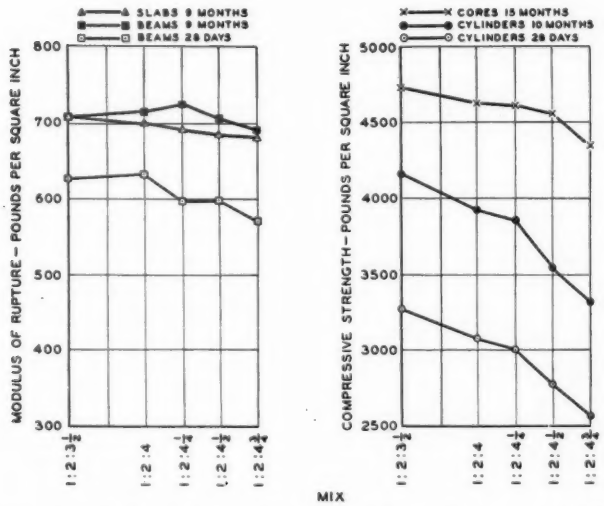

Fig. 2—Relation Between Strength of Stone Concrete and Mix

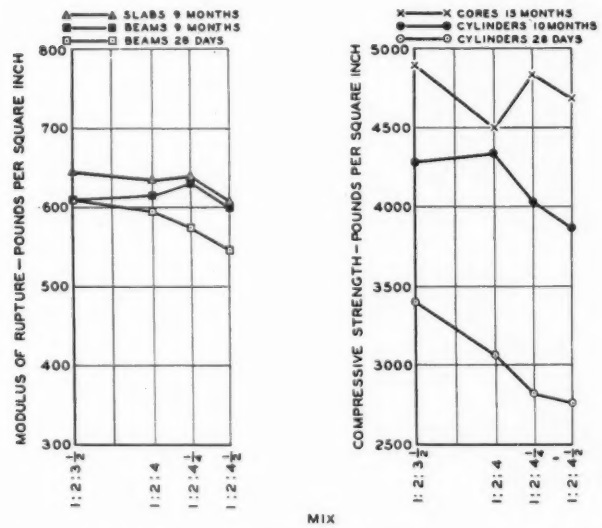

Fig. 3—Relation Between Strength of Slag Concrete and Mix

4 per cent honeycomb in spite of the fact that this was a distinctly oversanded mix, when analyzed either by mortar voids or fineness modulus theories. In the latter connection it may be noted that, for a 1:2:3½ mix, the volume of fine aggregate is 36 per cent of the sum of the volumes of fine and coarse aggregates. This is more sand than would be called for by the fineness modulus theory for these particular aggregates.

These tests also indicate that the slump test can not be used to compare workability of concretes in which different gradings

TABLE 11.—*Mortar-void ratio and* $\frac{b}{b_0}$ *for all proportions*[1]

Coarse aggregate	Proportions	Average water-cement ratio	Theoretical cement factor	Mortar-voids[2] ratio	$\frac{b}{b_0}$
			Sacks per cubic yd.		
Gravel, grading A; b_0=0.65; voids 35 per cent.	1:2:3½	0.86	5.53	2.13	0.717
	1:2:4	.91	5.14	1.89	.762
	1:2:4½	.92	4.84	1.68	.806
	1:2:4¾	.96	4.66	1.63	.820
	1:2:5	.98	4.52	1.55	.838
	1:2:5¼	.97	4.41	1.47	.858
Gravel, grading B; b_0=0.64; voids 36 per cent.	1:2:3½	.89	5.54	2.09	.719
	1:2:4	.92	5.17	1.85	.766
	1:2:4½	.99	4.81	1.69	.802
	1:2:4¾	1.01	4.66	1.61	.820
	1:2:5	1.05	4.51	1.55	.835
	1:2:5¼	1.02	4.41	1.46	.858
Stone, grading A; b_0=0.60; voids 40 per cent.	1:2:3½	.87	5.73	1.86	.743
	1:2:4	.91	5.35	1.66	.792
	1:2:4¼	.92	5.18	1.56	.816
	1.2.4½	.94	5.02	1.49	.836
	1:2:4¾	.97	4.86	1.43	.854
Stone, grading B; b_0=0.59; voids 41 per cent.	1:2:3½	.87	5.78	1.81	.749
	1:2:4	.91	5.39	1.62	.798
	1:2:4¼	.92	5.22	1.53	.822
	1:2:4½	.95	5.05	1.46	.841
	1:2:4¾	.97	4.90	1.39	.862
Slag, grading A; b_0=0.56; voids 44 per cent.	1:2:3½	.87	5.91	1.69	.766
	1:2:4	.93	5.50	1.52	.815
	1:2:4¼	.95	5.33	1.44	.838
	1:2:4½	.99	5.14	1.38	.857

[1] Computations were made on the basis of 38 per cent voids for sand and 50 per cent voids (assumed) for cement.
[2] The mortar-voids ratio for a given mix is obtained by dividing the sum of the absolute volumes of cement and sand plus the volume of water by the volume of voids in the dry-rodded coarse aggregate. This term should not be confused with the same term as used in the discussion of the mortar-voids theory.

of coarse aggregate are used. This is illustrated by reference to Figure 23. It will be seen that for a given slump, say one inch, the amount of honeycomb in the case of grading B gravel was much higher than for any other combination.

These data appear also to demonstrate that the use of any function depending directly upon the void content of the coarse aggregate, such as the ratio b/b_0 or the mortar-voids ratio, does not necessarily control the workability of the mix as determined by the uniformity and freedom from honeycomb of the concrete in the structure. They also indicate that, for a given coarse aggregate type and grading, there is a distinct relation between the consistency of the concrete as measured by the slump test and the percentage of honeycomb which is apt to develop under the methods of finishing now in common use.

Briefly, the above facts indicate that small size gravel is not as desirable an aggregate as the large size from the standpoint of workability and, further, that the stone concrete (grading A) was at least as workable as the gravel concrete (grading A) (large size). Certainly the grading A stone concrete was superior in workability to the gravel concrete (grading B) (small size) as judged by the amount of honeycomb in the underside of the finished slabs.

These facts are contrary to the wide-spread idea as to the relative workability of stone and gravel concretes and perhaps are revealed here for the first time in this most comprehensive and carefully conducted series of tests.

Uniform Cost Accounting Applied to the Crushed Stone Industry

By J. A. CONWAY, Accountant
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◆ The adoption of the Association's system for uniform cost accounting does not imply radical changes in present cost accounting systems and it would be unfortunate if the members failed to use the system because of such a belief. We believe that in the following article Mr. Conway clearly shows that with but slight changes the approved system can be put in use. His article well merits your careful attention.

THERE has been established for the crushed stone industry a system of uniform cost accounting. The system is described in detail in a Manual on Uniform Cost Accounting, published by the National Crushed Stone Association, a copy of which was recently forwarded to each member company. This Manual represents the work of the Association's Committee on Unform Cost Accounting extending over a two-year period of time. The principles portrayed in this Manual are simple of application and should immediately be put into general use throughout the industry. The following is really a continuation of the article by Mr. Conway which appeared in the August issue of the *Journal* and it is hoped that it will prove helpful in assisting member companies in adopting the system of uniform cost accounting approved by the Association.

Departmentalization

The first step to be taken in adopting the cost system is the setting up of three distinct groups of departments.

1. Production Centers
   - A. Stripping
   - B. Primary Drilling
   - C. Primary Blasting
   - D. Secondary Drilling
   - E. Secondary Blasting
   - F. Loading for Crusher
   - G. Hauling to Crusher
   - H. Crushing, Washing & Screening
   - I. Storage
2. Service Centers
   - A. Shops—Machine, Welding, Blacksmith, etc.
   - B. Power Plant, Air, etc.
   - C. Trucks
   - D. Horses & Carts
   - E. Shovels, Cranes, etc.
3. General Plant Expense
   - A. General Yard
   - B. Superintendents, Clerks, etc.
   - C. Miscellaneous, Buildings
   - D. Rental of Dwellings
   - E. Boarding House
   - F. Miscellaneous Trucking

Production Centers

The principal accounts under the heading of Production Centers are those accounts in which the stone advances from its raw or crude state until it finally emerges as crushed stone ready for sale.

Service Centers

Every plant has a number of activities not directly pertaining to production, but nevertheless essential parts of it. For example, the machine shop does repair work for the crusher. The labor of the machinists may be charged directly to the crusher so also the material used, but the overhead of the machine shop will have to be charged on another basis to arrive at accurate costs for the crusher operation. This overhead of the machine shop if charged to the crusher, at the close of each month, on the basis of cost per man hour, will give to the crusher its proportionate share of the costs of maintaining the machine shop and thereby, accurate cost for the crusher operation is obtained.

Other examples of service equipment are where shovels, trucks, cranes, etc., perform different tasks throughout the quarry. A shovel may load stone for the crusher part of the day and load stone from storage for direct shipments the other. In cases of this kind, all charges including labor, material and overhead should be charged against the shovel, and at the close of the month the various departments for which the shovel did work during the month should be charged on the basis of cost per hour of the shovel operation. If, however, shovels, trucks, cranes, etc., are stationary, that is they perform the same work for only one department at all times, they would not be classed as service equipment but would be included under production centers under their respective departments.

General Plant Expense

Under this classification are the departments or accounts which are essential to the operation of the plant but whose costs cannot be distributed to man hours or cost per hour of operation. Of course these costs could be distributed on some arbitrary basis

but in the breaking down of these accounts the total sum spent on these departments would be lost sight of, with the result that little in the way of cutting costs in these departments could be accomplished.

Reports

Labor Report

This report, for which there is one for each employee, provides a distribution of an employee's time for each pay period, columns being provided for the days of the month and the distribution of the time according to the operations engaged in. At the end of the pay period, these reports are totaled, extended and balanced out with the regular payroll book. They are then summarized on a columnar sheet so that there will be only one amount for each labor account charged. At the end of the month, this summary is sent to the main office, together with the individual labor reports. The total of this labor summary must agree with the total as set forth in the payroll book.

Truck Report

The work in which trucks are used in quarry operation is as follows:

1. Hauling rock to crusher
2. Hauling crushed stone to storage
3. Hauling crushed stone from storage
4. Stripping
5. Building and repairing roads
6. Hauling coal to shovels
7. Miscellaneous hauling trips outside of quarry

To distribute the time of trucks over the above jobs necessitates a daily report showing in what occupations the trucks were engaged and the time in hours so engaged. On these reports columns are provided for inserting the hours engaged in each operation. The total of the hours employed in each operation must equal the total time the truck was employed that day.

On this report there is also reported the gasoline and oil placed in the machine. A daily report is required for each truck even though it is laid up for repairs or not in use. These reports are collected daily and summarized so that at the end of each month the quarry office can report to the main office the total number of hours worked on any one job by each truck and for all trucks.

As these reports are a report of the work the trucks are engaged in and not the drivers' time reports, it will be necessary for the time-keeper to keep an account for each driver's time, all labor, drivers' time, and material being charged against the truck account and not the individual jobs upon which the truck works. At the close of the month the total charges are distributed over the operations in which the trucks were engaged on the basis of cost per hour of operation.

Shovel Report

The work in which shovels, cranes, etc., are used is as follows:

1. Stripping
2. Loading rock to be transported to crusher
3. Loading stone from storage for shipment
4. Building and repairing roads
5. Unloading coal from cars
6. Storing stone at storage

As in the case of trucks, daily reports showing in what work the shovels, cranes, etc., are engaged should be made out by one of the shovel crew. The same procedure of collecting and summarizing can be followed as was outlined under trucks.

Well Drill Report

To obtain accurate cost of well drilling necessitates a daily report for each well drill showing machine number, footage drilled, and quantity of gas and oil placed in machine. The procedure of collecting and summarizing as outlined under trucks can be followed.

Shop Reports

The machine, welding and blacksmith shops being service departments, daily reports, showing for what departments the repairs are being made, are necessary so that the overhead of these shops can be distributed to those departments for which work has been done. This can be accomplished by having each workman in the shops report daily on a scratch memorandum, the work in which he was engaged. The timekeeper upon receiving these reports will charge the workman's time direct to the department for which the work was done and at the same time record on a summary sheet the number of hours worked by departments. This summary is forwarded to the main office at the close of the month and forms the basis for distributing the overhead of the individual shop.

Power Plant Report

In plants where electric power is purchased a report showing the kilowatt hours consumed by each department is necessary. This report can be arrived at by charging the various departments, except crushing and screening, on the basis of the rated horsepower, taking into consideration the number of hours each motor operated during the month and charging the balance to crushing and screening.

In plants where steam power is used, conditions will have to be studied to learn what departments receive power and what proportion. This estimate should be checked from time to time to assure accuracy.

Material

Requisitions for Materials and Supplies

Whenever a purchase requisition is made out a brief explanation stating for what piece of equipment or for

what purpose the material is to be used should be written on the requisition, together with the account number to which the material is to be charged. On purchases made direct by the quarry, this information should be written on the vendor's invoice by the quarry office before the invoice is sent to the main office.

This practice is recommended in lieu of having material pass through a store room and later requisitioned out of stores, as quarry operations are usually spread over a wide area and the setting up of a store room would be of no real advantage considering the added expense and time lost.

Since a storeroom is impracticable for the average quarry operation it is, therefore, absolutely necessary that the material purchased be definitely assigned to one or more departments and that such assignment be noted on the requisition. Some purchases will of course be made that cannot be so assigned to any one department but are for the benefit of all departments. In cases of this kind the material should be distributed over the various accounts on the basis of what each department has used in the past.

The main office upon making up a purchase order upon receipt of a purchase requisition will make same as before, except on the copies held by the quarry operator the account to which the material is to be charged should be typed in. This is necessary to insure the charging to the proper account upon receipt of the material. A copy of the purchase order properly "okayed," should be attached to every vendor's invoice.

Exception to the above practice of assigning accounts to be charged at the time of ordering material is in the purchasing of coal, gasoline, and explosives which are inventory accounts.

Coal

The quantity of coal received during any one month should be reported on an inventory report together with the quantity used and the balance on hand. To secure the quantity used by each department, or each piece of equipment, conditions will vary in each quarry. The coal used by steam shovels is in some quarries hauled to them by trucks. The driver of the truck, hauling this coal, should weigh each load and note this weight on his daily truck report. These weights should be summarized at the quarry office and at the close of the month reported to the main office. Other quarries use a horse and cart to haul coal to shovels, the same practice can be used here as in the case of trucks. A better plan, if possible, would be to have a separate and distinct storage pile of coal for the use of shovels only. In this case an estimate of the amount of coal left in the pile would be all that would be necessary, the difference between the quantity placed in the pile and what was on hand would be what was used.

Locomotive engineers, crane operators and all those in charge of equipment on which coal is used should report daily the amount of coal they have received on some basis which is practicable for that particular quarry.

Gasoline

A scratch pad should be fastened alongside the pump or at some other convenient place and all withdrawals of gasoline be noted thereon, except gasoline drawn by trucks, well drills or other equipment which report separately through daily reports. This withdrawal report should be collected daily, summarized and at the close of the month sent to the main office.

The difference between the inventory at the beginning of the month plus gasoline received during the month less the quantity reported as used during the month should equal what gasoline is on hand. From time to time actual physical check should be made and adjustments properly made.

Explosives

This account should be charged with all explosives purchased regardless of whether such purchase is for Primary or Secondary Blasting. Withdrawals should be noted daily so that the inventory report at the close of the month will reveal where and for what purpose explosives were used and the quantity remaining on hand.

General Books

The general books necessary to record transactions properly in the crushed stone industry differ very little from the books of any manufacturing concern.

They are as follows:

1. General Journal
2. Cash Books
   Receipts & Disbursements
3. Sales Book
4. Accounts Payable Register or Purchase Book
5. Distribution of Accounts Payable Register
6. General Ledger.

In adopting the cost accounting system no change will be necessary in the General Journal, Cash Books, Sales Books or General Ledger. In accounting for purchases of material and supplies a change may or may not have to be made depending upon the adaptability of the present distribution scheme.

The classification of accounts as adopted by the National Crushed Stone Association has subdivided material and supplies as follows:

Operating Material
  Tools
  Oils and Greases
Repair Material

In other words, there are about 20 principal accounts and three subdivisions of each principal account making a total of about 60 different accounts to which material and supplies are to be charged for each quarry.

If the present distribution records can readily care for this distribution, no change will be necessary, but should it be cumbersome or unwieldly it would be advisable to adopt a more appropriate record. With this new record, material can be accounted for with ease and in many cases be quicker than the record discarded.

The total amount of the postings in the Accounts Payable distribution book should agree in total with the Accounts Payable Register.

The total charges against any one quarry for material and supplies, that is, the total for all of the 60 accounts previously mentioned, should be posted in one amount to the quarry cost account appearing in the General Ledger.

The individual postings of each subdivision of each principal account should be posted to the operating ledger, a subsidiary record of the General Ledger.

Wages is posted to the operating ledger from the Labor Distribution Summary, the total amount only appearing in the Accounts Payable Distribution book thereby eliminating the necessity for 60 additional accounts in this record.

General Ledger

The accounts appearing in the General Ledger under the heading of each quarry are as follows:

1. Coal
2. Gasoline
3. Explosives
4. Freight
5. Fire, Insurance Paid Accounts
6. Royalty Paid Account
7. Sales
8. Taxes Paid
9. Quarry Cost
10. Stripping
11. Primary Drilling
12. Quarried Rock on Quarry Floor
13. Crushed Stone at Storage
14. Depreciation

The sources of entries to these accounts are as follows:

Coal Account—Charged with purchases and freight on coal from Accounts Payable Distribution Book.

Credited monthly with cost of coal consumed as per the Coal Distribution on the Inventory Report.

Gasoline Account—Charged with purchases from Accounts Payable Distribution Book.

Credited with the cost of gasoline consumed as per the gasoline distribution on the inventory report.

Explosive Account—Charged with purchases and freight from Accounts Payable Distribution Book.

Credited monthly with cost of explosives consumed as per Inventory Report.

Freight Account—Freight on shipment of stone from Distribution Book.

Freight on material and supplies is charged to the same account as the material.

Fire Insurance Account—Charged with insurance from Accounts Payable Distribution Book.

See "Accruals" for charges to costs.

Credited at the close of the year with the insurance accrued from the Operating Ledger.

Royalty—Charged with Royalty payments from Accounts Payable Distribution Book.

See "Accruals" for charges to costs.

Credited at close of year with total Royalty Accrued from the Operating Ledger.

Sales—Credited from Sales Book.

Adjustments charged or credited from Journal.

Taxes—Charged with taxes paid from Accounts Payable Distribution Book.

See "Accruals" for charges to costs.

Credited at close of year with Taxes Accrued.

Quarry Cost Account—Charged monthly with the total of wages from Distribution Book.

Charged monthly with the totals of Material from Distribution Book.

Charged monthly with Coal, Gasoline and Explosives consumed as per Inventory Report from Journal.

Charged or Credited monthly with the total of all general journal entries affecting the Operating Ledger.

Charged or credited with total of all cash book entries affecting the Operating Ledger each month.

Stripping, Primary Drilling, Quarried Rock, Crushed Stone in Storage—Charged at the close of the year with total charges during the year as per the Operating Ledger.

Credited at the close of the year with total credits during the year as per the Operating Ledger.

The debit balance as shown at the close of the year remaining the same throughout the following year, changes only being recorded in the Operating Ledger.

Accruals

Royalty Account—Royalties under leaseholds are usually based on the tonnage sold. In order to obtain accurate costs these royalties should be taken in as a part of the cost of production. This can be accomplished by charging the Production monthly with the sum of the tonnage produced multiplied by the royalty rate. The credit to this charge is posted to the Royalty Account column in the Accrued Accounts account in the Operating Ledger.

At the close of the year the Balance of the Accrued Royalty Account is transferred to the credit side of the General Ledger Account, Royalties Paid.

The credit balance remaining in the Royalties Paid Account after applying to it the Accrued Royalties Account will be the Royalties Accrued on stone in ground storage or in the bins.

Insurance—At the close of each month the various departments should be charged with 1/12 of the annual insurance premiums, the credit to this charge being

posted to the Insurance Column in the Accrued Accounts account in the Operating Ledger.

The balance in the Accrued Insurance Account at the end of the year is transferred to the General Ledger Insurance Accounts after the same have been adjusted for prepaid premiums.

The above applies to all insurance except Compensation Insurance. Compensation Insurance is charged into production costs monthly on the basis of the amount of the Payroll multiplied by the Insurance Rate, the procedure being the same as the other insurance.

Depreciation—Procedure same as Royalties. In an effort to keep costs constant a rate per ton predetermined on the basis of estimated production is preferred to that of using 1/12 of the annual depreciation as a monthly charge against production.

Operating Ledger

The operating ledger, a subsidiary record of the general ledger, is the record in which all items affecting costs at the plant and quarry are posted. It is always in balance with the controlling account "Quarry Costs" appearing in the general ledger. A monthly trial balance should be taken, to prove the accuracy of the work, after monthly costs have been distributed.

This operating ledger is made up of columnar sheets having ten columns, with a space on the side for noting remarks.

It receives its data from the following sources:

1. Labor from the Payroll Summary made up at the plant.
2. Material and Supplies from the Accounts Payable Distribution Book.
3. Coal, gasoline and explosives from General Journal.
4. Accruals from the Accrual Account (A page in the Operating Ledger).
5. Cash Book Entries affecting costs.
6. Journal Entries affecting costs.

A trial balance of the Operating Ledger would appear as follows:

Debits	*Credits*
Stripping	Accruals
Primary Drilling	Inventories at Beginning of the year
Quarried Rock	
Crushed Stone at Storage	Balance of Quarry Cost Account appearing in General Ledger
Cost of Sales	

Closing Procedure—Operating Ledger

All service department accounts are closed first, because their costs are distributed over the departments for which they performed some task.

Power Plant Account—Closing date: Balance closed out at the end of the month.

Accounts to which transferred:

1. Well Drilling
2. Crushing, Washing & Screening
3. Secondary Drilling
4. Machine Shop
5. Blacksmith Shop
6. Welding Shop
7. All other Departments receiving Electric Power.

Report from which data is obtained: Electric Power Distribution Report on a kilowatt hour basis.

Procedure: The total number of kilowatt hours the plant was working during each month is obtained from the electric company bill or by a reading of the meter. The average unit cost per kilowatt hour is obtained by dividing the balance in the Power Plants Account with the total number of kilowatt hours the plant consumed. The amount chargeable to the accounts controlling the class of work which consumes electric power is obtained by multiplying the kilowatt hours consumed by the average unit cost per kilowatt hour. The sum of these charges must always equal the balance in the account.

This procedure would be the same in Steam Plants where various departments receive power from the one source.

Shop Accounts—Closing Date: Balance closed out at the end of each month.

Accounts to which transferred: All departments for which work was performed by shops.

Report from which data is obtained: Summary of labor report of employees in shops.

Procedure: The average unit cost per hour is obtained by dividing the balance in the account with the total number of man-hours worked during the month by the shop employees. The amount chargeable to the various accounts controlling the class of work in which the shop employees were engaged is obtained by multiplying the number of hours so engaged by the average unit cost per hour. The sum of these charges must always equal the balance in the account.

Truck Account—Closing date: Balance closed out at the end of each month.

Accounts to which transferred: All departments for which work was performed by trucks.

Report from which data is obtained: Summary of truck operation.

Procedure: Same as Shops using Truck-Hours in operation as the basis.

Shovels, Cranes, etc., Accounts—Closing date: Balance closed out at the end of each month.

Accounts to which transferred: All departments for which work was performed by shovels.

Report from which data is obtained: Summary of Shovel, Cranes, etc., report.

Procedure: Same as Shops using Shovel-Hours in operation as the basis.

After the service department accounts are closed and distributed for the month the other accounts may be closed, the order of which does not matter since all service charges have been distributed.

Stripping Account—Closing date: At the end of any

month in which rock which has been stripped of its overburden or is blasted by means of a primary blast.

Account to which transferred: "Quarried Rock" or "Rock on Quarry Floor."

Report from which data is obtained: Inventory report.

Procedure: The average unit cost per ton of rock stripped is obtained from the stripping account. The tonnage which has been blasted and reported on the Inventory Report is valued at the average unit cost per ton. The Stripping Account is then reduced both in tonnage and amount by the value of the rock blasted.

Example: The balance in the stripping account shows 100,000 tons of rock stripped at a cost of $10,000.00 or average unit cost of 10 cents per ton. The Inventory Report states that 5,000 tons of stripped rock have been blasted. At the average unit cost of 10 cents per ton, the 5,000 tons of stripped rock blasted has a value of $500.00. The Stripping Account is then reduced by the 5,000 tons valued at $500.00. The new balance carried forward will be 95,000 tons at a value of $9,500.00.

Primary Drilling Account—Closing Date: At the end of any month in which rock which has been drilled (Primary), is blasted or lost by means of a primary shot.

Account to which transferred: "Quarried Rock" or "Rock on Quarry Floor."

Report from which data is obtained: Inventory Report.

Procedure: The average unit cost per foot is obtained from the Primary Drilling Account. The feet drilled which have been blasted or lost and reported on the Inventory Report are valued at the average unit cost per foot. The Primary Drilling account is then reduced both in feet and amount by the value of the holes blasted.

Examples: The balance in the Primary Drilling account shows 800 feet drilled at a cost of $2,400.00 or an average cost of $3.00 per foot. The monthly Inventory Report states that 500 feet of Drilled Holes have been blasted. At the average unit cost of $3.00 per foot, the 500 feet of drilled holes have a value of $1,500.00. The Primary Drilling account is then reduced by the 500 feet valued at $1,500.00. The new balance carried forward will be 300 feet at $900.00.

Primary Blasting Account—Closing Date: At the end of the month in which a primary shot has been made.

Account to which transferred: Quarried Rock.

Report from which data is obtained: Inventory Report.

Procedure: Entire balance is transferred to the Quarried Rock Account.

Quarried Rock Account—This account is a perpetual inventory in tons and amount of the blasted rock available for crushing. At the end of any month in which a primary blast occurs this account is charged with all or a portion of the Stripping, Primary Drilling and Primary Blasting Accounts in the manner described under those respective accounts. The tons dropped by the primary blast which is the tonnage with which this account is charged is reported on the Inventory Report at the end of each month. This report of tons dropped should theoretically be the same as the number of tons dropped reported on the stripping report. At the end of the year the tons remaining in the account should be checked by a physical inventory and any differences adjusted.

The balance in the account divided by the Inventory Report of the tonnage dropped by blast is the unit cost per ton to be used as a basis for the monthly cost entries.

Account to which transferred: Cost of Production.

Report from which data is obtained: Tons of stone dumped into crusher.

Procedure: The number of tons reported dumped into the crusher is multiplied by the unit cost per ton and the amount thus obtained together with the tonnage reported is charged to the Production Account.

Secondary Drilling and Blasting Accounts—Closing Date: Balance closed out at the end of each month.

Account to which transferred: Cost of Production.

Loading Stone for the Crusher Account—Closing Date: Balance closed out at the end of each month.

Account to which transferred: Cost of Production.

If the shovels in the quarry are only used for this purpose the charges are made direct. If, however, the shovels are moved from the quarry for other work, then the charges for shovel operation are transferred to this account from the service department "Shovels,"

Transporting Stone to the Crusher Account—Closing Date: Balance closed out at the end of the month.

Account to which transferred: Cost of Production.

If the equipment in the quarry is used only for this purpose the charges are made direct. If, however, the equipment such as trucks is used for other purposes then the charges for truck operation are transferred to this account from the Service Department "Trucks."

Crushing, Washing & Screening Account—Closing Date: Balance closed out at the end of the month.

Account to which transferred: Cost of Production.

General Plant Expense—

General Yard Account
Superintendents and Clerks Account
Quarry Dwelling Account
Boarding House Account
Insurance Group Account
Insurance Compensation Account
Miscellaneous Truck Account
Taxes
Royalties

The above General Plant Expense accounts are closed out each month to the Cost of Production Account.

Cost of Production Account

Closing Date: Balance closed out at the end of each month.

Accounts to which transferred:

1. Cost of Sales (direct shipments)
2. Crushed Stone Inventory (storage)

Report from which data is obtained: Production, Shipments and Storage.

Shipping Account (Main Railroad)

Closing Date: Balance closed out at the end of each month.

Accounts to which transferred:

1. Cost of Sales (direct shipments)
2. Storage Expense (storage)

Report from which data is obtained: Production, Shipments and Storage.

Scale House Account

Closing Date: Balance closed out at the end of each month.

Accounts to which transferred:

1. Cost of Sales (direct shipments)
2. Storage Expense (Storage)

Report from which data is obtained: Production, Shipments and Storage.

Storage Expense Account

Closing Date: Balance closed out at the end of each month.

Accounts to which transferred: Cost of Sales.

Report from which data is obtained: Production, Shipments and Storage.

Cost of Sales Account

Closing Date: Balance closed out at the end of the year.

Account to which transferred: Profit and Loss Account: General Ledger.

The difference between the balance of this account and the net sales account for each quarry will equal the Profit or Loss.

Crushed Stone Inventory Account

This account is a perpetual inventory account in tons and amount of the crushed stone stored at the storage yard. At the end of each month this account is charged with the value and the tonnage stored and credited with the value and tonnage shipped from storage during the month.

Conclusion

Quarry Operators after reading this article will no doubt say that the cost accounting system as approved by the National Crushed Stone Association is not for them as they would have to stop operations so that they could catch up with the necessary reports and procedure connected with it. This is far from the truth, as the writer can arrive at the costs of three plants in a day and a half with ease, and has at times, done it in one day.

Over 250 Million Dollars Saved Through Simplified Practice

"MORE than 10,000 different associations, and firms are now listed by the Division of Simplified Practice of the National Bureau of Standards as acceptors to simplified practice recommendations," according to Edwin W. Ely, chief of that division.

"The most remarkable thing about this steady rise in number during the past 10 years," said Mr. Ely, "is the increasing interest in simplified practice as shown by consumers of the commodities simplified. The present demand on the services of the division by the user group almost equals that of the manufacturers and has resulted in a closer cooperative relationship among producers, distributors and consumers."

There are now in effect over 120 simplified practice recommendations, and the total number of acceptances to all recommendations number nearly 30,000.

Savings, due to the application of simplified practice recommendation, according to responsible sources in the various industries affected, total more than 250 million dollars. Individual firms have reported that they are saving thousands of dollars annually.

In April state and federal aid contracts were awarded amounting to $96,879,468; May was around $70,000,000. Reports from the New York State Highway Department show 18,000 men employed on highway construction in the State as compared with 7,000 employed at the same time last year. State highway contracts amounting to around $30,000,000 were let in New York up to June 1 which is $9,000,000 more than were let up to the same time last year.

"The trend toward budgeting highway expenditures over a period of years shown in the financing plans of a number of states has made possible the budgeting of paving work so that the needs of different communities can be met adequately," stated W. R. Smith, president of the association. "The public in each section of the country likes to know when each of its roads will be improved. Such budgeting has been made possible through motor vehicle taxes which supply an income that can be predicted safely.

"Any diversion of the motor vehicle taxes from use on the public roads is greatly to be deplored," he concluded, "and the public generally demands that such funds be used for roads only."

A Scots Wager

Two Scotsmen went fishing, with an understanding that the first one to catch a fish was to buy the "soda." One got a bite that almost broke has line, but refused to pull up. The other was fishing without bait.

—*New Zealand Railways Magazine*

Report of Interpretation Committee—Trade Practice Rules

By OTHO M. GRAVES, Chairman
President, General Crushed Stone Co.,
Easton, Pa.

◆ The Trade Practice Rules of the Crushed Stone Industry as approved by the Federal Trade Commission in April, 1930, following the Trade Practice Conference of the industry, held in Cincinnati, in January, 1930, were recently revised and modified by the Commission and submitted to the industry through its Trade Practice Committee for approval or rejection. The procedure followed and the rules in modified form as finally approved by the Commission are given in the following report of the Committee which was submitted to the Board of Directors at its mid-summer meeting.

UNDER date of May 29th we were informed by the Secretary of the Federal Trade Commission that the Commission had reconsidered its action on rules of the crushed stone industry adopted by the industry at a Trade Practice Conference held in Cincinnati, Ohio, on the twenty-third day of January 1930. We were further informed that to the extent that the industry approved and adopted the rules as modified by the Commission, that upon notice thereof, the Commission would consider them as Rules of the industry and that if the Commission was not informed of such approval and adoption by the industry of the modified rules within sixty days from May 29th, it would withdraw its approval and acceptance of each and all rules for the industry.

The Committee, through its Chairman, replied under date of June 3rd, pointing out that a Trade Practice Conference for the industry could not feasibly be called and held within sixty days and asking if the Commission construed that the Trade Practice Committee, as created under Rule B, Group II, has the authority to accept the modifications required by the Commission thereby binding the industry to their acceptance. A copy of this correspondence was sent to President Worthen. The reply, dated June the 11th, from the Commission stated that the "final action upon trade practice conference rules was sent only to committees of the industries and not to individual members of the industry. It was the intention of the Commission that the Committees either act for the industries within the sixty day period mentioned in the letter of May 29th or notify the individual members of the industry. The method to be adopted by the committee in ascertaining the views of the industry is for the committees and not the Commission to determine, the committees being at liberty to choose their own method." It was also stated, by the Secretary, that the Commission would not authorize another Trade Practice Conference for consideration of the changes set forth in its letter of May 29th. It therefore appeared to the Chairman of the Committee and to the President of our Association that the Commission regarded the Committee as having authority to act for the industry though the Commission would not choose the method to be followed.

It did not seem wise or feasible to endeavor to secure a mail vote from each member of the industry as to its viewpoint regarding the modifications. Consequently a copy of the first letter received from Mr. Johnson, as well as the original and modified rules, were sent to each member of the Trade Practice Committee asking that each member vote as to whether or not the Committee should act for the industry. The replies from the members of the Committee authorized the Chairman to notify the Secretary that the modifications were approved by the Committee on behalf of the industry with the exception of one member who expressed doubt as to the authority of the Committee to act for the industry and therefore deemed it prudent to refrain from voting. By virtue of the vote of the Committee the Chairman, under date of July 9th, notified the Secretary of the Commission that "By majority vote of the members of the Trade Practice Committee of the industry, I am authorized to inform you that on behalf of the industry the Committee accepts the rules as modified by the Commission which were submitted with your letter of May 29th." The Commission has replied by letter of July 13th to the effect that the Commission now regards the rules as modified as those of the industry, and that in due course "a statement of the rules as changed will be sent by the Commission to each member of the industry for the information of each individual." The original rules as adopted at the Cincinnati Trade Practice Conference in January, 1930, and as subsequently approved by the Commission in April, 1930, as well as the form in which they are now modified, are submitted at the conclusion of this report. The Committee holds that the modifications do not materially affect the spirit and intent of the original rules.

The purpose of the Commission in modifying the Rules is apparently twofold; first, to effect standardization throughout all the industries which have adopted Trade Practice Rules and, secondly, to further prevent any possible conflict with the Department of Justice by approving rules which in form might be questionable. There has been widespread criticism of the Commission to the general effect that its attitude is constantly weak and continually vacillating. The

Chairman of your Committee is a member of the Standing Committee, Congress of Industries, which has endeavored to prevent a further weakening of the Rules adopted by various industries; in this endeavor it does not seem to have been particularly successful. Nor has the action of the Commission in further modifying substantially all Trade Practice Rules met with unanimous approval within the membership of the Commission. Commissioner Humphrey issued a broadcast criticizing the action of the Commission and setting forth his personal opinion which summarized is as follows:

1. He favored changing some rules in Group I, so as to make the rules conform with the law but opposed any change in the language as adopted by the industry, except in so far as it was necessary to accomplish this purpose.

2. He opposed changes in Group II Rules.

3. He opposed the "standardization" of the rules and protested against such change in each industry. He believed that such "standardization" was not justified and did great injury to the industries concerned.

4. He believes that "standardization" was the cause of the evils that grew out of the revision.

One of the members of your Committee has suggested that the industry adopt its own rules without regard to the Federal Trade Commission; set up the necessary machinery for their enforcement and levy fines for their violation. The danger of such a procedure would be that rules might be adopted which the Department of Justice would hold to be contrary to the law rendering us liable to prosecution. The advantage of a Trade Practice Conference lay in that rules that were adopted were by and with the advice and counsel of the Federal Trade Commission which would stand between an industry and the Department of Justice. It may be that the apparently vacillating and weak policy of the Commission is really based upon its fear that it may lead an industry into conflict with the Department of Justice and that to prevent such an unfortunate contingency it uses extreme care and caution thereby giving the impression that it "draws the teeth" from trade practice rules and weakens them unnecessarily. The Chairman of your Committee is inclined to think that until the status of the Federal Trade Commission is more definitely defined by Federal Statute the members of the Commission will be reluctant and hesitant to take any firm stand such as is really required by industries seeking to purge themselves of economic and industrial evils.

In conclusion, your Committee is of the opinion that under Rule B, Group II, it has authority to accept on behalf of the industry the rules as modified by the Commission; that such acceptance is desirable in order that we retain approval of our rules by the Commission; and that the Commission is not likely to pursue a firmer and more vigorous policy in view of the uncertainty of action by the Department of Justice and the obligation which the Commission feels to fully protect each industry whose rules it approves.

Trade Practice Rules

for the Crushed Stone Industry

as modified by the Federal Trade Commission

July 13, 1931

GROUP I

Rule 1

The Commission substituted and approved the following for Rule 1, as published April 15, 1930:

Maliciously inducing or attempting to induce the breach of existing contracts between competitors and their customers by any false or deceptive means whatsoever, or interfering with or obstructing the performance of any such contractural duties or services by any such means, with the purpose and effect of unduly hampering, injuring, or embarrassing competitors in their businesses, is an unfair trade practice.

Rule 1, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The willful interference by any person, firm, corporation or association, with any existing contract between a seller and a purchaser, in or about the production, manufacture, transportation, purchase or sale of any product handled by the industry, or the performance of any contractual duty or service connected therewith, such interference being for the purpose or with the effect of dissipating, destroying or appropriating, in whole or in part, the patronage, property or business of another engaged in such industry, is an unfair trade practice.

Rule 2

The Commission approved Rule 2, as published April 15, 1930, which reads as follows:

The false marking or branding of products of the industry with the effect of misleading or deceiving purchasers with respect to the quantity, quality, size, grade or substance of the materials purchased, is an unfair trade practice.

Rule 3

The Commission substituted and approved the following for Rule 3, as published April 15, 1930:

The sale or offering for sale of any product of the industry by any false means or device which has the tendency and capacity to mislead or deceive customers or prospective customers as to the quantity, quality, substance or size of such product is an unfair trade practice.

Rule 3, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The sale or offering for sale of any product of the industry accompanied by misrepresentations calculated to deceive customers or prospective customers as to the quantity, quality, size, grade or substance of such product, is an unfair trade practice.

Rule 4

The Commission substituted and approved the following for Rule 4, as published April 15, 1930:

The secret payment or allowance of rebates, refunds, commissions, or unearned discounts, whether in the form of money or otherwise, or secretly extending to certain purchasers special services or privileges, not extended to all purchasers under like terms and conditions, with the intent and with the effect of injuring a competitor and where the effect may be to substantially lessen competition or tend to create a monopoly or to unreasonably restrain trade, is an unfair trade practice.

Rule 4, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

(*Continued on page 25*)

Opportunities for Extending the Use of Stone Sand in Masonry Mortars

By F. O. ANDEREGG, Ph.D. [1]

◆ The crushed stone producer is constantly confronted with the problem of disposing of surplus fines. "Stone Sand" has been the answer in a number of instances and Dr. Anderegg feels that we have an excellent opportunity of extending its use in the building industry.

THE poor grading characteristics of many commercial sands offers an opportunity to manufacturers of crushed stone to render a real service to the building industry either by supplying the deficiencies in the gradings of the sand or by producing a properly graded stone sand. The former can often be conveniently done by those manufacturers producing agricultural limestone incident to their regular production; while the latter may be produced in a single grinding operation, provided the right grinding equipment is chosen relative to the stone to be crushed.

At present, rivers, lakes or seas and sand banks are being drawn upon for sand for building operations and it is only a question of time before the supply will be inadequate for the demand. Again, where the deposits are greatest, as along certain lakes, the poor grading often limits the usefulness. These facts indicate for the crushed stone manufacturer an increasing outlet for his fines. In certain localities the opportunity, of course, will come much sooner than in the others, but even now a real need exists for suitable materials to supply the lack in, or even to replace, certain of the commercial sands, especially for those applications where workability is important.

Workability Influenced by Fine Aggregate

The workability of mortars and concretes is influenced to a considerable extent by the grading of the fine aggregate. And since the quality of the product, at least under ordinary methods of application, depends so greatly upon workmanship, the desirability of materials with which the workman can do his best work is self-evident.

In the higher grades of cement products such as cast stone, stucco, terrazzo, and even in the lowly cement block, crushed stone is becoming increasingly important, but a further opportunity occurs in masonry mortars. No single factor contributes so vitally to the speed, neatness and quality of the masonry as the workability of the mortar, and the aggregate contributes an important part of the workability. At the same time when selecting the grading giving very good workability, a high degree of compacting may be secured; and the importance of density in securing durability hardly needs emphasis.

Workability and Packing in Masonry Mortars

The mathematical principles of packing of aggregates have been laid down by C. C. Furnas[2] and applied to mortars by the writer.[3]

If a standard set of sieves is used for screen analysis, differing in dimension by the constant factor of two, the arrangement of particle sizes which gives best workability and very good packing is such that the weight retained on each sieve is 1.2 times that on the next smaller. Another type of grading, where two or three sizes are used, gives still better packing, but the workability is so poor that, unless special means of application are available the continuous grading following the 1.2 ratio gives much better results. Examples of the intermittant type of grading are found in terrazzo work and in the remarkable stucco application of John J. Early of Washington, D. C.

Importance of Grading

While making an investigation of brick masonry with special reference to damp interiors at the Mellon Institute of Industrial Research,[4] the problem of sand grading was encountered. Not only in the local sands but also in many of the sands from various parts of the country deficiencies in grading were encountered. Typical grading curves are plotted in the figure where curve A is for the ideally graded sand, curve B is a harsh, coarse river sand. Curve C represents a finer river sand, while D is a typical lake sand.

An illustration of the importance of the grading of the sand is found in the fact that a certain masonry cement of good plasticity will carry, when measured damp and loose, five volumes of sand A, about two and a quarter of sand B, about three and a half of sand C and less than three of sand D, when made up according to the judgment of a mason who had a good reputation as a mechanic. With a properly graded crushed stone aggregate the same cement should carry about four volumes. But with a recommendation of the 1:3 mix, a desirable safety factor is introduced to allow for increased weather resistance, for possible deviations in grading from the ideal and for the lesser sand carry capacity of many masonry cements.

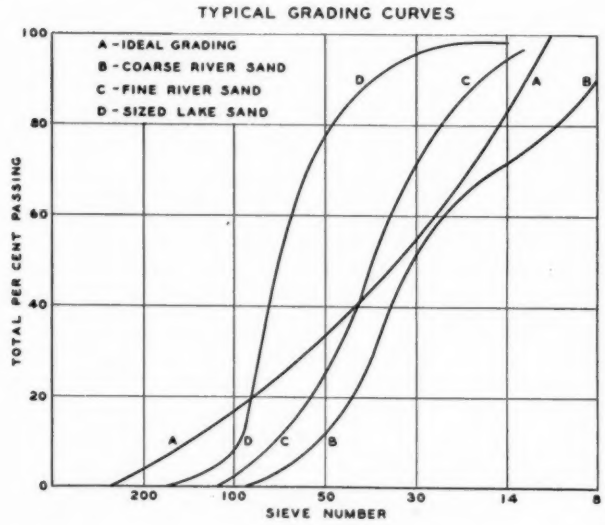
[1] Consulting Specialist on Building Materials, Fulton Building, Pittsburgh, Pa.

[2] Furnas, C. C. The Grading of Aggregates. 1. Mathematical Relations for beds of Broken Solids of Maximum Density. *Industrial and Engineering Chemistry*, September. 1931.

[3] Anderegg, F. O. II. Application of Mathematical Formulas to Mortars. *Industrial and Engineering Chemistry*, September 1931.

[4] Anderegg, F. O. An Experimental Study of Brick Masonry with Special Reference to Watertight Construction. *Architectural Record*, September, 1931.

An experiment with the cement-lime mixture 1:1:6 recommended[5] for general application when applied to sand B was illuminating. On mixing one volume of portland cement and one of lime putty with this sand, the limit of sand carry capacity was four volumes. That makes a rich mix which, when not tool finished



at just the right stage (close to the point of initial set), produces many shrinkage cracks in the mortar.

By adding to this 1:1:4 mix one volume of crushed limestone so graded that a residue of about 15% remained on the 50 mesh sieve and not more than about 15% passed the 200, another volume of sand could be added giving a nice fat mortar of good working characteristics, and one that showed much better adhesion to the brick. The decrease in cement and lime in the modified mix compensated for the extra expense involved in the addition of the limestone, and the mortar quality was improved. Incidentally, the fine stone increases the whiteness of the joint.

For the finer sands small amounts of coarser stone, say ranging from 10 down to 30 mesh size, can be added often to improve the quality of the mortar. A sized sand such as is represented by Curve D makes so poor a mortar that it should not be permitted for masonry cement work.

Importance of Fine Aggregate Long Recognized

Vetruvius, the Latin authority on architecture, in the second chapter of the second volume of his ten books written about 100 A.D. 12 has this to say,[6] "After slaking the lime, mix your mortar, if using pit sand, in the proportion of three parts of sand to one of lime; if using river or sea sand, mix two parts of sand with one of lime. Further, if using river or sea sand, the addition of a third part composed of burnt brick pounded up and sifted, will make your mortar of better composition to use." Very evidentally the Romans appreciated the importance of the fine aggregate.

Conclusion

In conclusion, there can be little doubt that poorly graded sands have been a contributing factor in many of the troubles found in masonry work. Where such sands are prevalent the crushed stone industry has a real opportunity in either supplying deficiencies in the local sand or by supplanting it with properly graded stone sand. The appeal is made to the crushed stone producer to look into this matter carefully with the idea of rendering this service to the building industry.

[6] Vetruvius. Ten Books of Architecture, translated by M. H. Morgan. *Harvard University Press*, 1914.

Federal-Aid Construction Reaches New Record

MORE than 1,150 miles of Federal-aid road construction was completed during July, one of the highest figures ever reached in such construction and possibly a new high record, and the estimated cost of roads still under construction as of July 31 advanced to $388,003,532, according to information made available orally August 25 at the Bureau of Public Roads, Department of Agriculture. The following additional information was made available:

Expansion of the road building program as a measure to combat unemployment has resulted in a record rate of absorption of Federal-aid and emergency road funds administered by the Bureau.

Last September 30 there were $172,500,000 of unobligated funds on hand in the Bureau, and since then $80,000,000 of emergency road construction funds have become available. These funds have been absorbed at such a rate that there remain available for new projects only $30,543,556 of regular Federal-aid funds and less than $5,000,000 of the emergency fund.

The additional $80,000,000 was provided by Congress for advances to States for use by them in matching regular Federal-aid road funds. The act appropriating this fund provided that it must all be used by September 1, 1931. As of July 31, $3,464,136 of this fund had been allotted for projects approved but not yet started, and these projects must be finished by the end of the month if the money is to be used.

New York led July 31 in estimated cost of roads under construction, with Illinois second, Texas third, and Ohio fourth. Projects in New York totaled nearly $40,000,000, and in Illinois nearly $27,000,000. Projects totaling more than $10,000,000 for each State were under way also in California, Indiana, Massachusetts, Michigan, Montana, and Pennsylvania.

While there are no estimates available in the Bureau of the amount of employment provided by the enlarged program, it is probable that the volume of employment on the Federal-aid road system has been running above normal.

« « EDITORIAL » »

An Economic Expense

EACH and every crushed stone producer of the United States and Canada should be present at the Fifteenth Annual Convention of the National Crushed Stone Association which will be held at the William Penn Hotel, January 19 to 22, 1932.

Today, the keynote of the business world seems to be to cut down on expenses and certainly no one would quarrel with this principle, provided in cutting down expenses real economies are effected. The danger lies, however, in the unfortunate tendency for many to become panicky and to slash expenses without rhyme or reason in the foolish belief that by merely reducing them, there will inevitably result economies in operation.

Upon first consideration it may seem to some that by eliminating the expense incident to attending the annual convention, an excellent opportunity is offered for curtailing expenses, but such a decision can by no means be justified on the basis of economy.

The convention of today, representing as it does a serious conference of business men, has taken its proper place as a necessary instrumentality of modern business. It would indeed take an optimist to see any benefit in the present business depression, and yet, if it has served no other purpose, it has brought out in bold relief the advantages which exist, in times of economic stress, from capably organized group action.

Seldom, if ever before in the history of our country, has the business world been confronted with such complex problems and with such conflicting ideas as to the proper solution of them. Suggestions which a few years ago would have been branded as radical are being made today and seriously considered by the foremost thinkers of the country. Industrial America is on the verge of a new economic era and no industry or individual can afford to ignore the handwriting on the wall. New conceptions as to the relations between labor and capital, between different industries and between the component parts of a single industry, are rapidly coming to the foreground and cannot be ignored. Organized, cooperative effort would certainly seem to offer one of the most effective channels through which real progress can be made.

The National Crushed Stone Association represents the organized, cooperative effort of the crushed stone producers of the United States and Canada. Its annual convention this year is more necessary and by the same token more important than ever before. Many new problems have arisen since we met last January in St. Louis and much is yet to be done in solving the old ones. As an aid in this direction the annual convention has no substitute. There is nothing which adequately takes the place of personal contact and the convention offers us once a year the opportunity of personally meeting together to discuss our common problems and exchange ideas with regard to our future development. Our forthcoming convention will be a business conference of men who have a mutuality of purpose. It will offer us the opportunity of freely and frankly considering the many internal problems which confront us.

Nor can we be concerned only with a consideration of our internal problems. Business men today are rapidly coming to a recognition of the fact that their respective industries are but a cog in the wheel of industry as a whole and that consequently the economic progress of the country is to a large extent dependent upon the interrelation of various groups. But a moment's thought is necessary to visualize the many industries which vitally affect the welfare of the crushed stone industry, to say nothing of those whose prosperity is dependent to a more or less degree on a progressive and healthy condition of our own industry.

Our problems are by no means insurmountable. It is true, however, that if they are to be satisfactorily solved, the best thinking of which we are capable will be required. Our annual convention affords us an opportunity, such as no other medium does, to take stock of the situation and intelligently plan for the future. A solemn obligation rests upon each member of the industry to contribute his utmost by being present at this annual conference. Failure to do so will constitute a loss which no producer can afford to bear.

Make no mistake about this; by foregoing attendance at the Pittsburgh Convention you can decrease expenses, but as you begin to cope with the problems confronting you next year, you will come to realize that your decision was a most expensive one.

Know Your Costs

UNDER stress of present circumstances it is only natural that crushed stone producers are endeavoring in every possible way to conduct their operations more economically and it would seem obvious that in order to effect economies in operation, it is first necessary to know which phases of the operation are not being carried on efficiently. It also seems to be a common fault of human nature that we frequently look far afield and many times unsuccessfully for solution to our problems when as a matter of fact the tools which would prove most effective are close at hand.

After some two years of intensive study, the Asso-

ciation's Committee on Uniform Cost Accounting has made available to the crushed stone industry a Manual on Uniform Cost Accounting which constitutes the most effective tool which has so far been devised for quarry operators to know definitely and positively the total costs of their operations as well as the individual costs of the various phases of the operation. To many it will seem entirely unnecessary that we advocate through these columns a wide and extended use of this Manual on Uniform Cost Accounting and yet frequent contacts with members of the industry, both large and small, very forcefully indicate that there are many producers who have but scant and incomplete information regarding their operating costs.

"Know your costs" would seem to be a necessary prerequisite upon which any sound business can be built. Without a full and complete knowledge of costs, how is it possible to intelligently determine upon a selling price? We do not hold for a moment that costs throughout the industry should be uniform, for we are all aware of the varying conditions of production which would make this impossible. We do, however, say that there is much to be gained by having well established, uniform methods of computing costs, and we cannot too strongly urge the members of the industry to adopt in all of its essential particulars the method of keeping costs recommended by the Association's Committee on Uniform Cost Accounting.

The objection will no doubt be raised that this cannot be accomplished without increasing the personnel and making many changes which would seem inadvisable. Such is positively not the case—with but slight changes and modifications in present systems, the methods recommended by our committee can be put into operation in all essential particulars. Elsewhere in this issue there are discussed in detail in an article by Mr. Conway the various considerations involved in the Association's system, and we cannot too earnestly recommend that every producer give this article a very careful reading. Additional copies of the Association's Manual on Uniform Cost Accounting are available at the Secretary's Office in Washington for a nominal charge. Immediate adoption of this system will, without doubt, show you many ways in which to reduce your expenses and will at the same time contribute measurably to the stability of your industry.

Manufacturers' Division Will Hold Annual Dinner Meeting in New York

THE annual dinner meeting of the Manufacturers' Division of the National Crushed Stone Association will be held at the New Yorker Hotel, New York City, on the evening of Friday, October 23, beginning at 6.30 p. m. As has been the custom for a number of years the Executive Committee of the National Association will meet for luncheon on the same day and remain over for the Manufacturers' Division dinner in the evening. Word has just been received that the New York State Crushed Stone Association will also hold its regular monthly meeting at the New Yorker on the twenty-third, and all of its members are most cordially invited to be present at the dinner in the evening.

The Manufacturers' Division wishes to take this opportunity of extending to all who may find themselves in New York or the immediate vicinity on the twenty-third a most cordial invitation to participate in their annual dinner. Plans regarding the forthcoming exposition of the Division to be held in conjunction with the Association's Fifteenth Annual Convention at the William Penn Hotel, Pittsburgh, next January, will be discussed, and action taken on such other business as may properly come before the Division at this meeting.

We are also advised that the New York State Crushed Stone Association will meet for luncheon and that they are particularly desirous of having all manufacturers who can possibly do so arrange to be with them.

Reservations for the dinner should be made by writing direct to Gordon Buchanan, C. G. Buchanan Co., 90 West St., New York City, under whose supervision the detailed plans are being made. All indications point to a most enjoyable affair and it is hoped that all who can possibly do so will be present.

Highways for 1931 to Cost Over Billion and Half

PROGRAMS of Federal, State and local governments for road construction in the calendar year 1931 call for a total expenditure of $1,616,000,000, an increase of approximately $15,000,000 over the 1930 calendar year, according to a statement made public recently by the White House based upon a survey conducted by the Bureau of Public Roads, Department of Agriculture.

The Federal Government's contribution to the road-building program is placed at $259,897,000 or an increase of $154,249,000 over the calendar year 1930.

Programs of local highway and bridges call for estimated expenditures of $586,340,402 in the calendar year 1931, a decrease of $77,326,598, as compared with the preceding calendar year.

Expenditures on State and highway construction programs for the calendar year 1931 are estimated at $1,029,770,161, an increase of $92,269,706 as compared with the calendar year 1930. Under the latter program, 39 States show an increase of $165,205,241 over the calendar year 1930, while 9 States show a decrease of $72,935,535.

Prepared stone sand is being increasingly used and with excellent results.

« « WITH THE LOCAL ASSOCIATIONS » »

Texas Producers Establish Safety Record

THE Texas Crushed Stone, Sand and Gravel Association enjoys the distinction of including among its members two companies who won meritorious recognition in the Safety Contests for 1930, the results of which have recently been announced. The Potts-Moore Gravel Co. won the safety trophy for 1930 in the safety contest between sand and gravel producers of the United States. In the safety contest between crushed stone producers of the United States the No. 2 limestone quarry of the Southwest Stone Co. received honorable mention for having completed the year 1930 with no lost-time accidents.

In honor of their winning the safety trophy for 1930 the Potts-Moore Gravel Company gave a barbecue to its employees at the company's recreation grounds and clubhouse located on the banks of the beautiful Brazos River. The Texas Sand and Gravel Company, neighboring operators, were present to assist in the festivities. Mr. R. J. Potts, President of the company, expressed his gratitude to the employees for winning the trophy and his sincere appreciation of the interest which his employees take in the company's welfare. W. W. Carson, Jr., Executive-Engineer of the Association, was then introduced, and, after a few remarks, asked W. F. Wise, former President of the National Crushed Stone Association, to present the trophy to Mr. Sam Moore, Superintendent of the Potts-Moore Gravel Co., who received it for the men. It is interesting to note that in the contest among sand and gravel producers for 1929 the Urbana Sand and Gravel Co., which is also a member of the Texas Crushed Stone, Sand and Gravel Association, won the trophy.

The No. 2 limestone plant of the Southwest Stone Co., although making a perfect record in the 1930 safety contest among crushed stone producers, did not win first place because of the fact that other companies also making perfect records had a larger number of man-hours of exposure. For receiving honorable mention the plant of the Southwest Stone Co. will receive a parchment reproduction of *The Explosives Engineer* Award and each employee of the plant will receive a certificate of award appropriately inscribed from the National Crushed Stone Association. Presentation of these awards will be made at the forthcoming annual convention of the Association which will be held in Pittsburgh next January.

It would certainly seem that the producers of aggregates in Texas are well versed in the technique of avoiding accidents, and we can do no less than to wish them the best of success in the field of accident prevention in the years to come.

New England Producers Hold Annual Outing

THE second annual outing of the New England Crushed Stone Association was held on August 21 at Worrick Inn, Nantasket, Massachusetts, which is located on the coast a few miles outside of Boston. The entire day was turned over to the business of having a good time. The program began with a luncheon served at 12.00 o'clock noon, the afternoon being devoted to sports and entertainment, many of the members indulging in tennis, golf and baseball. The annual dinner was held in the attractive dining room of Worrick Inn and the delicious seafood dinner featuring clams and lobsters was thoroughly enjoyed.

The meeting was exceptionally well attended, including many state and county highway officials and the President and Secretary of the National Association. At the conclusion of the dinner Bernard McKin-

Among those present at the Second Annual Outing of the New England Crushed Stone Association

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A proven product, which will increase your producing efficiency and decrease your maintenance costs.

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Brooklyn, New York

ney, President of the New England Crushed Stone Association, called the meeting to order and brief addresses were made by President Worthen and Secretary Boyd. It was also the pleasure of the meeting to hear from some of the highway officials who were present. Although this was but the second annual outing of the Association, it would seem from the enthusiasm displayed that a precedent has been established for many enjoyable affairs in the years to come.

Pennsylvania Group Discusses Plans for National Convention

THE outing meeting of the Pennsylvania Stone Producers' Association, held on August 27 at the Old Dutch Barn of the Bethlehem Steel Corporation, a few minutes ride from Bethlehem, Pennsylvania, must go down on the record as being one of the most enjoyable affairs of this type held in recent years. The old barn, with its hand-hewn rafters, surrounded by corn fields and an apple orchard, provided an ideal setting for the informal Dutch luncheon and meeting which followed. During the morning an opportunity was afforded those desiring to do so to inspect the plant of the Bethlehem Mines Corporation, a subsidiary of the Bethlehem Steel Corporation, and much interest was evidenced in the production of stone sand. The inspection was conducted by M. L. Jacobs, Manager of Quarries.

Immediately following the luncheon, the meeting which was held outdoors was called to order by President Earnshaw. Plans for the forthcoming convention of the National Association to be held in Pittsburgh next January were the first topic for discussion. It was clearly indicated that the Pennsylvania producers are fully aware of their responsibilities in acting as host to the National Convention and that they are undertaking to discharge this office in a manner which will be highly creditable and pleasing to all concerned. It was pointed out that under present conditions there is a marked tendency among trade associations to frown upon lavish and excessive entertainment and there is no one who would question the desirability of following such a policy. On the other hand, it is recognized that a reasonable amount of entertainment is a proper background for the serious work accomplished during our convention, and the Pennsylvania producers have already set in motion machinery which will be adequate to assure that as hosts they will live up to the excellent reputation established by their predecessors.

After discussing plans for the annual convention and hearing a report from the Budget Committee, President Earnshaw called upon A. L. Worthen, President of the National Association, A. T. Goldbeck, Director of the Bureau of Engineering, and J. R. Boyd, Secretary, for remarks. These national officers outlined the work of the Association and showed the many

ways in which the national organization can be of assistance to its members.

The meeting concluded with a discussion of the present highway program in Pennsylvania and what work is contemplated in the future.

New York Association Meets at LeRoy

THE regular monthly meeting of the New York State Crushed Stone Association was held on September 3 at LeRoy, New York. The morning was devoted to an inspection of the "Colprovia" and "Amiesite" plants located at LeRoy, followed by a typical barn dinner which everyone thoroughly enjoyed.

The business meeting was held at "Len" Heimlich's Cabin but a few minutes distant from LeRoy. One of the most important matters to come before the meeting was the proposed action of the State Highway Department to require washing of all crushed stone in the 1932 specifications and contracts. It was evident from the discussion that took place that this proposed action of the State gave real concern to the producers operating in New York. It was decided that the Association Committee which conferred with State Highway Commissioner Brandt on July 13 should again meet with him, accompanied by A. T. Goldbeck, Director of the Bureau of Engineering of the National Association, in an effort to obtain more definite information with regard to the proposal. J. R. Boyd, Secretary of the National Association, was then called upon by President Owens for remarks. Secretary Boyd described briefly the many services which the national organization is in a position to render its members and in particular the benefits which had been derived from the Bureau of Engineering. He especially condemned the practice of price cutting and encouraged all members to adopt as early as possible the method of uniform cost accounting approved by the Association's Committee on Uniform Cost Accounting.

After expressing to Mr. Heimlich, through a standing vote, the Association's appreciation of his efforts in its behalf, the meeting adjourned about 4.30 p. m.

Report of Interpretation Committee

(*Continued from page 18*)

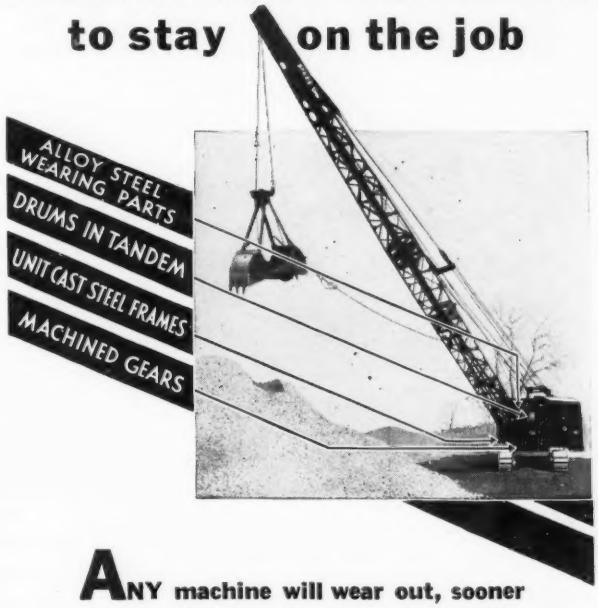
"The secret prepayment of transportation charges and/or the secret payment or allowance of rebates, refunds, credits, or unearned discounts whether in the form of money or otherwise, or secretly extending to certain purchasers special service or privileges not extended to all purchasers under like terms and conditions, with the intent and with the effect of injuring a competitor and where the effect may be to substantially lessen competition or tend to create a monopoly or to unreasonably restrain trade, is an unfair trade practice.

Rule 5

The Commission substituted and approved the following for Rule 5, as published April 15, 1930:

It is an unfair trade practice for any person engaged in interstate commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities, where the effect of such discrimina-

It takes Real Sturdiness to stay on the job



ANY machine will wear out, sooner or later. And everyone knows that the faster the wear, the higher will be the costs of maintenance, the more frequent the breakdowns, and the costlier the time lost for repairs.

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tion may be to substantially lessen competition or tend to create a monopoly in any line of commerce: provided that nothing herein contained shall prevent discrimination in price between purchasers of the same class on account of differences in the grade, quality or quantity of the commodity sold, or that makes only due allowance for differences in the cost of selling or transportation, or discrimination in price in the same or different communities made in good faith to meet competition: and provided further, that nothing herein contained shall prevent persons engaged in selling the products of this industry in commerce from selecting their own customers in bona fide transactions and not in restraint of trade.

Rule 5, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

Any discrimination in price between purchasers of the same class, not including discrimination in price on account of the difference in grade, quality or quantity of the product sold, or which makes only due allowance for difference in cost of selling and transportation, or discrimination in price in the same or different communities made in good faith to meet competition, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly, is an unfair trade practice.

Rule 6

The Commission substituted and approved the following for Rule 6, as published April 15, 1930:

The defamation of competitors by falsely imputing to them dishonorable conduct, inability to perform contracts, questionable credit standing, or by other false representations, or the false disparagement of the grade or quality of their goods, with the tendency and capacity to mislead or deceive purchasers or prospective purchasers, is an unfair trade practice.

Rule 6, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The defamation of a competitor by words or acts imputing to him dishonorable conduct, inability to perform contracts, or questionable credit standing, or the false disparagement of the grade or quality of his materials, is an unfair trade practice.

Rule 7

The Commission approved Rule 7, as published April 15, 1930, which reads as follows:

The selling of goods below cost with the intent and with the effect of injuring a competitor and where the effect may be to substantially lessen competition or tend to create a monopoly or to unreasonably restrain trade, is an unfair trade practice.

Rule 8

The Commission substituted and approved the following for Rule 8, as published April 15, 1930:

Directly or indirectly to give or permit to be given or offer to give money or anything of value to agents, employees, or representatives of customers or prospective customers or to agents, employees, or representatives of competitors' customers or prospective customers, without the knowledge of their employers or principals, as an inducement to influence their employers or principals to purchase or contract to purchase industry products from the maker of such gift or offer, or to influence such employers or principals to refrain from dealing or contracting to deal with competitors, is an unfair trade practice.

Rule 8, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The secret paying, or promising to pay, to an employee of a customer, or prospective customer, without the knowledge of his employer, of a commission or consideration of any character for the purpose of inducing or compensating for a sale, is an unfair trade practice.

Rule 9

The Commission substituted and approved the following for Rule 9, as published April 15, 1930:

Maliciously enticing away the employees of competitors with

the purpose and effect of unduly hampering, injuring, or embarrassing competitors in their businesses is an unfair trade practice.

Rule 9, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The enticement of employees from a competitor for the purpose of interfering with his business is an unfair trade practice.

Rule 10

The Commission substituted and approved the following for a part of Rule C, Group II, as published April 15, 1930:

Offering for sale merchandise at a price reduced from a marked-up or fictitious price with the tendency and capacity to mislead or deceive purchasers or prospective purchasers is an unfair trade practice.

Rule C, Group II, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The industry hereby records its approval of the practice of each individual independently publishing his prices and terms of sale to the purchasing trade. The publication of fictitious prices and terms of sale by a manufacturer for the purpose of misleading the trade and the public is condemned by the industry.

GROUP II

Rule A

The Commission substituted and accepted the following for a part of Rule C, as published April 15, 1930:

(a) The industry approves the practice of each individual member of the industry independently publishing and circulating to the purchasing trade its own price lists.

(b) The industry approves the practice of making the terms of sale a part of all published price schedules.

Rule C, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The industry hereby records its approval of the practice of each individual independently publishing his prices and terms of sale to the purchasing trade. The publication of fictitious prices and terms of sale by a manufacturer for the purpose of misleading the trade and the public is condemned by the industry.

Rule B

The Commission substituted and accepted the following for Rule D, as published April 15, 1930:

A Committee on Trade Practices is hereby created to cooperate with the Federal Trade Commission and to perform such acts as may be proper to put these rules into effect.

Rule D, as published April 15, 1930, which the Commission declined to approve or accept, reads as follows:

The Crushed Stone Industry hereby authorizes the National Crushed Stone Association to take such steps as may be necessary to appoint a Committee on Trade Practices to investigate whether these resolutions are being observed, to make complaints concerning alleged violations, cooperate with the Federal Trade Commission and generally to perform such other acts as may be reasonably necessary and proper to put these resolutions into effect and to accomplish the objects and purposes of this Conference.

The Commission declined to approve or accept the following rules as published April 15, 1930:

Rule A, Group II

The offering or giving of commissions, prizes, premiums, gifts or excessive entertainment to any one in connection with the sale, purchase or use of any product distributed by manufacturers within this industry, or as an inducement thereto, is condemned by the industry.

Rule B, Group II

The practice of making sales on an f.o.b. factory basis on all shipments except within local delivery limits enables the purchaser to know the cost of the product, exclusive of freight charges, and is a commendable custom and recommended by the industry.

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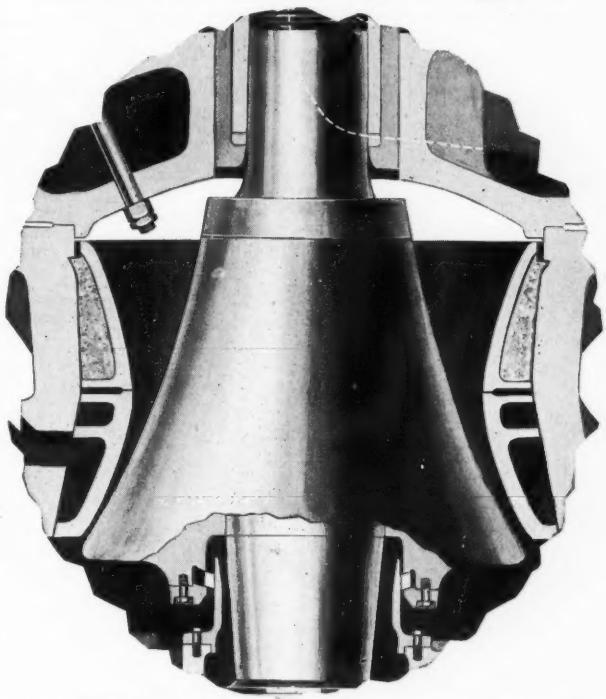

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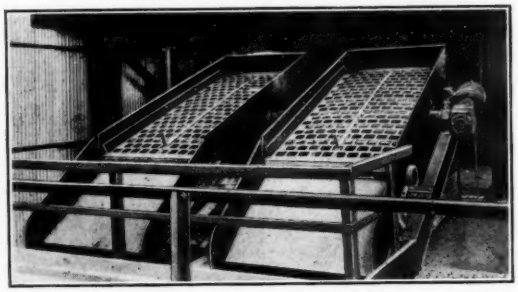

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Photo No. 1, showing bad cracks in this dipper. Both were over 23" in length.

Photo No. 2, showing same dipper after welding with TIMANG. It is now back in service.

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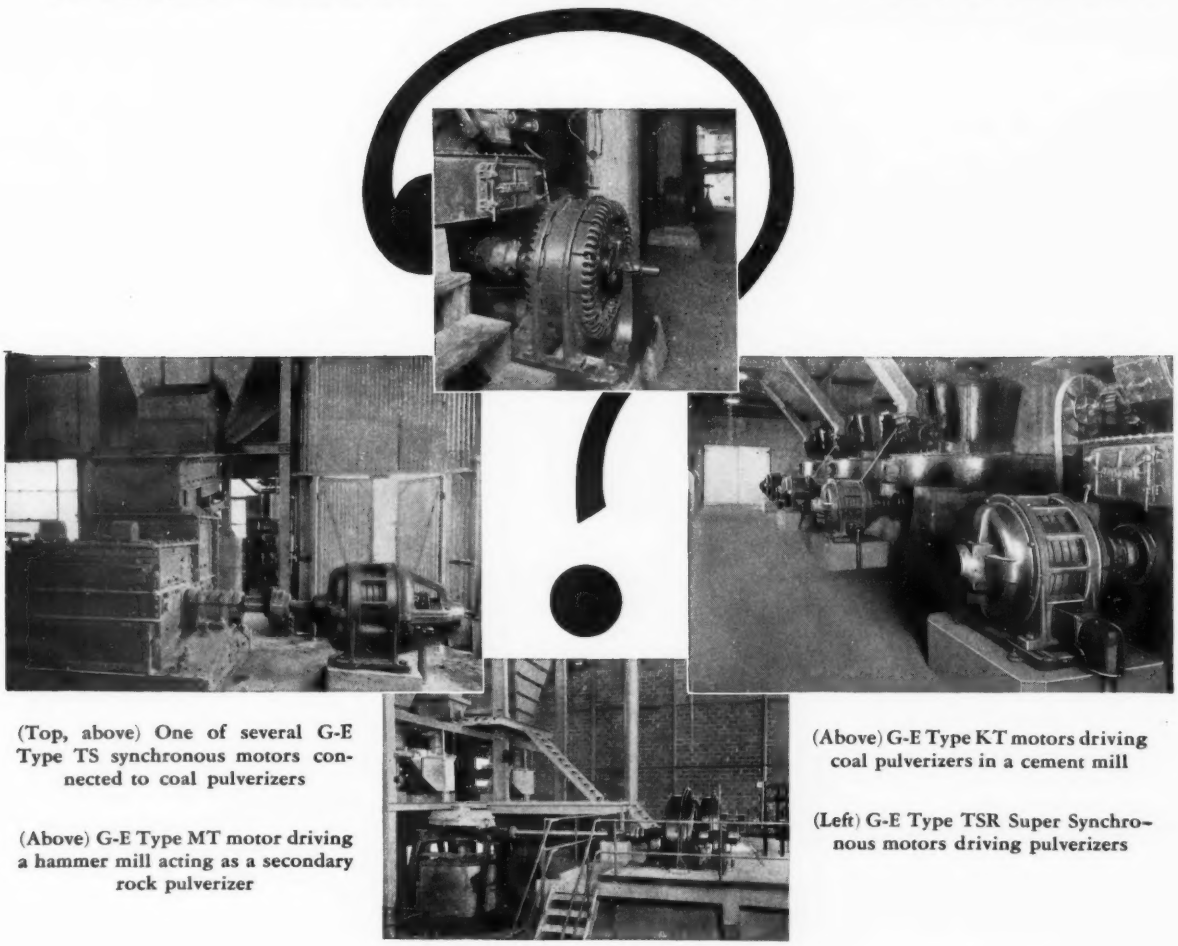

(Top, above) One of several G-E Type TS synchronous motors connected to coal pulverizers

(Above) G-E Type MT motor driving a hammer mill acting as a secondary rock pulverizer

(Above) G-E Type KT motors driving coal pulverizers in a cement mill

(Left) G-E Type TSR Super Synchronous motors driving pulverizers

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